ers, both in and out of the public service, who really believe that there has been notable progress along the lines of scientific investigation in this country since 1789, it presents a common goal towards which all may strive; a higher ideal of the relations of science and the government, and a more patriotic conception of the true relations between the intelligent citizen and the government in a genuine republic.

J. R. EASTMAN.

WASHINGTON, D. C.

THE NEW YORK STATE SCIENCE TEACHERS' ASSOCIATION.

III.

THURSDAY, December 31st, two sessions were held in the new Medical College of Syracuse University. The morning meeting was devoted to Biology. Professor C. W. Dodge, of the University of Rochester, read a paper on 'Biological Work in the High School.'* He was followed by Dr. Thomas B. Stowell, of the Potsdam Normal School, with a paper entitled:

The Educative Value of the Study of Biology.

MR. PRESIDENT: Memory of the many days that we have labored together in the Biological Laboratory gives me greater boldness to continue this discussion, for I shall rely upon you, sir, to supply whatever may be lacking in my argument to make sure defense of the cause which I gladly espouse.

I shall outline my idea of the educative value of the biological studies from two standpoints: their value by virtue of the psychology of the study; and second, because of the demands of practical life. And I shall venture to concrete my conclusion by suggesting methods and measures to make this scheme effective and operative.

*At the request of the Association, Professor Dodge repeated this paper, which he prepared last spring for the University Convocation of the State of New York. It is printed in Regents' Bulletin, No. 36, September, 1896, pp. 46–62.

Two problems confront us at the threshold of practical life: the ever present 'bread and butter' problem, type of all utilitarian questions; and processes or procedures to effect desired ends, *i. e.*, the multiple forms of ethical questions whose solution depends primarily upon taste, for I take it that men differ little in conclusions from demonstrable or even from probable premises, which are intellections; the radical difference in men is in taste, or in the emotions which prompt to specific action.

The final cause of study is both cultural and utilitarian; forces or agencies which afford increased facility in developing and in directing the energies or the activities of soul are termed cultural; the results of these forces, that which discovers what is utilized or may be used in every-day life, that which conduces to personal comfort and pleasure, and that which fosters the discovery of such forces and ends are practical, utilitarian.

I shall not contend for the ultilitarian value of the nature studies, for their contribution to temporal comfort, to happiness, to longevity and to prosperity is generally conceded.

The discussion is restricted to the cultural value of such studies. To fit men for life in a broad sense demands such soul-furnishing as will insure correctness in judgment; acquisition of such habits as will guarantee prompt action; and assurance of conduct conformable with the high standards espoused. If I err not, a critical examination of the school curriculum will disclose the fact that its final cause is intellectual acumen rather than moral power; in other words, intellectual activity rather than emotional is the purpose of the schools. I do not decry the schools of to-day; I do not advocate lowered standards, but I urge most persistently the need of culture of the emotional life which is the spring, the source of conduct. Modern psychology has happily

abandoned the hypothesis of faculties, and studies the self, the soul as a unit. This discussion assumes the constancy of the aggregate of soul energy and its non-correlation with radiant energy; in other words, *the number of units of soul energy, potential and kinetic, is constant.* The radical difference then between the educated and the illiterate is in the ratio of potential to kinetic power.

This defines the province of the school, which is to furnish proper stimuli to render active and available the possible, inherent and inherited energy.

There is little debate regarding the order of succession, and the dependence of the forms of mental activity. Admitting that nearly every form seems to be involved or implied in every other form it is customary and convenient to speak of these forms as separate. Following this order, the first end sought in an educative procedure is to effect a sensorial modification, *i. e.*, to produce a definite change in the cortical cells, which change automatically induces a corresponding change in the self or the soul and gives it form or experience, or the precondition of knowledge.

These partial and vague experiences, percepts, must be related, interpreted; they must receive *meaning* which is put into them by virtue of their relations to previous and correlated experiences, else they necessarily remain unintelligible. The condition of experience thus interpreted by the self to the self is what contemporary pedagogics terms appercept, the basis of all clear, definite, positive knowledge.

I have thus briefly outlined the first stages in intellectual activity to get more clearly before this body the reason for my position in my first contention which is:

Contention 1. *That the study of biology is preeminently adapted to awaken those psychoses —forms of soul-activity—which prepare for the demands of practical life.*

I am not prepared to admit that content of mind is secondary in soul development. I am aware that we recall individual and exceptional cases where we have been accustomed to concede great learning with little ability for application; but I am led to raise two questions at the very beginning of the inquiry: 1st. In these cases has the existence of apperceptive scholarship been definitely established? 2d. If this be conceded, has it been shown that under proper stimuli there is the claimed lamentable weakness? I am not contending for restricted specialization, but I do hold that the ignoring of the value of mind content has been and still is a lamentable weakness in the school curriculum. Let me again recur to the primary law of knowledge development, viz: that percepts must be related and interrelated before definite meaning or knowledge can be predicated. The failure to insist upon clear, verifiable forms is a prolific source of superficiality and of baneful habit. Something more than effort is needed. I cannot concur with the traditional dogma that the educative value of a process inheres in the effort. Nerve tracts are not trained to definite and specific response by ill-directed conditions. Meaning cannot be put into new forms from vague percepts. The character of the form acquired is too important to be ignored or even to be relegated to a secondary position.

It seems to me, sir, that a radical defect in educational theory has grown out of a misconception of the nature of so-called mental power. It is a matter of grave moment what is studied, what is known; and it is of far greater importance to heed well the habits formed and the tastes induced. The failure of men who address themselves to the various avocations in life; the numberless wrecks occasioned by futile attempts to occupy positions for which neither heredity nor education has prepared ought to be sufficient demonstration of the fallacy of the 'ef-

fort' hypothesis, and ought to provoke serious controversy regarding the nature of mental power. How long must we observe that success in a given kind of work is no guarantee of success in another, and that expertness in one direction is an almost infallible proof of mediocrity in another, before we shall concede the *specific* nature of mental power. It is this concession which gives preeminence to modern pedagogics. It is impracticable and unphilosophical to talk about symmetrical development. My contention so far has been to show the superior value of nature study as a source of material for sensuous stimuli which are the basis of all knowledge of the outside world and of its myriad relations; and, furthermore, the source of those stimuli which will induce precise and economic action of nerve centers and nerve tracts, a prerequisite to the formation of habit and taste. I concede the spiritual nature of these psychic forms, but I contend for their physical basis.

Accepting the proposition as established, the question arises by what agencies can habits be induced which will insure promptness and accuracy of execution. The demand of the age is for ability to totalize energy, to focalize power and quickly. This is my second contention: *That in culturing value nature studies are not surpassed by other branches of study.*

Conceding that nature study does not furnish all the data demanded for the solution of all of life's problems, I still hold that the habits induced by their study and, what is of far greater importance, the tastes developed are of superior value in training to manliness. Dr. Kuss says that "the association of conception with ideas and their union with feelings and aspiration is under the control of education." And Dr. Radestock vigorously states that "scientific education is only worth anything and is of vital importance when its actions, powers and means have become firm and steady habits;" and Rousseau, more than a century since in his Emile, "Education is certainly nothing but a formation of habits;" and Locke, a century earlier, "We must expect nothing from precautionary maxims and good precepts, though they be deeply impressed on the mind, beyond the point at which practice has changed them to firm habits." These citations are made in corroboration of what has been advocated. I do not contend that the humanities are wanting as means to the desired end, but by reason of their less sensuous nature they are not as well adapted to form the beginnings of habit which they admirably strengthen and supplement.

My third contention is that *the study of nature is preeminently ethical, since the exactness demanded by all scientific research fosters and necessitates love of truth.*

It seems hardly necessary to mention in this presence the value of nature study as promotive of the habit of truthfulness. That the ethical value of scientific training has been questioned may be referred to the early practice of advocating this study because of the attractiveness of objective and concrete study, until many regarded nature study as a sort of amusement or entertainment. I assume that the larger portion of this audience is connnected with some one or more of the scientific associations of the country. I need but call attention to the character of the papers, and to their criticism to demonstrate the fact that with the student of science *truth is supreme.* With him hypotheses are abandoned as cheerfully and as promptly as they are formed. Experience teaches that this ability to set aside cherished ideas is not easily acquired, but the very inexorableness of nature schools men to place priceless value upon truth. A scientific liar is a misnomer, a self-contradiction.

The importance of the habit of truthfulness is worthy of greater emphasis than the

limits of the paper will permit. I cannot refrain from calling attention to the clearness with which the students of biology learn that the omission of a single step in the treatment of tissue, or even the slightest variation from a specified course of procedure, will invariably modify or invalidate the results attained. This lesson has great educative value in impressing upon the mind the consequences of variation from truth in all procedures, demonstrations or speculations.

Having given so large a portion of my time to the discussion of pedagogical principles, I hasten to the suggestion of modes and measures to make this scheme effective and operative.

Whenever the teacher is prepared by previous training to present the subject of comparative zoology, my experience of 21 years as teacher of biology has convinced me that the best results can be secured with students of high-school grade by beginning with the simplest unicellular organisms and proceeding to the more complex. The pupil who has a clear, definite knowledge of an amœba is prepared to comprehend the structure of complex forms, and with this knowledge he cannot fail to grasp the secret of animal morphology. When some of the more complex forms are studied minutely the problem presents two phases: shall one form be studied minutely, and shall the available time be given to the study of a few types, or shall the study of a single type be less exhaustive and a larger number of types be examined?

I am satisfied that I have secured the best results by the study of many types, for comparative study rendered the knowledge of each type apperceptive, and the enlarged circle of experience gave the enlarged interest based upon enlarged knowledge which cannot exist with a restricted content to the concept. Thus in the study of the cœlenterata we examined not only a simple hydra, but studied one or more complex marine forms, some from actual alcoholic specimens, others by means of charts and diagrams. Polyp, anemone (Metridium), jelly-fish (Aurelia), holothurian (pentacta), sea-urchin (Toxopneustes), sand-dollar (Echinarachnius), brittle-star (Ophiopolis), not only aid in the formation of a correct concept of the Coelenterate type, but the knowledge gained from the study of each makes the study of the others more significant. I do not hesitate to affirm that the examination of half a dozen type specimens carefully dissected by the teacher will give a clearer and better knowledge of the type in one class period than a week's study of a single specimen by an untrained pupil who is vaguely working in the dark, with scalpel and specimen, acquiring habits of wastefulness and slovenly generalizations. Where time and appliances will permit, more individual work is desirable; the best and the most economical mode known to the writer is that inaugurated and followed by Dr. B. G. Wilder, of Cornell University, in what he has happily named Practicums.* But quantity is essential to quality, a principle true in every line of research. Something more than effort is demanded.

After careful training to observation of the significance of homologues it is of great value to let each pupil trace a type structure, *e. g.*, the distribution of a spinal nerve in two or more types, as in the cat, dog, rabbit, and learn the significance of persistence of type-forms. No exercise of mind can be made more conducive to that judicial habit which is essential in every department of life and yet is so rare.

From a utilitarian standpoint all this knowledge of animal structure and function becomes the basis of the study of

* Outline directions for these Practicums can be obtained by addressing B. G. Wilder, Ithaca, N. Y. Price, $1.00.

human anatomy and physiology. The vexed and vexing problem of how to teach the effects of narcotics in our schools can not be solved until our teachers are more thoroughly grounded in the matter to be taught and their profound convictions have awakened corresponding emotion which will result in consistency in instruction and in life.

Time forbids detailed mention even of an outline course of study of botany, the most easily taught and the most available of the biological subjects. It should have a place in every grade from the kindergarten to the University.

I am met with the objection that proper equipment of schools for study of biology and anatomy is expensive. To which I gladly make reply: The equipment of a school for the study of English or of the Classics is expensive, but who ever argued against the study of Latin or Greek because of expense of lexicon or grammar or text, and furthermore the objection is based upon a misapprehension of the facts. It is not necessary to have a museum in every school. Type-forms alone are required. Fresh-water clams, snails, slugs with the convenient salt-water clams are accessible for a few cents, and these furnish the data for the study of the lamellibranchs, their differentiæ and their homologies. Fresh-water and marine lobsters are within reach of every school, and no one will complain because of scarcity of material for the study of insects.

The study of the life history of a common beetle will fix in the mind of the student the relation of environment to life more vividly, hence more availably than tomes of unintelligible literature, made unintelligible because of lack of experience as the foundation of interpretation.

It may matter little whether a stray bone belongs to ruminant or rodent, but it matters not a little whether the boy who finds the bone has awakened in him a desire to know its relation and whether he knows how to proceed to solve the problem. The habit of comparative study, the ability to give just values to data, to weigh evidence, so indispensable to success, but alas, so rare, cannot be over estimated.

Time limitations exclude the discussion of the value of the habit of confidence in ultimate discovery of truth. The attitude of soul with which the student of nature addresses himself to a given task is no less sublime than that with which the Priest of Israel entered the Holy of Holies to have direct audience with the *I Am*. This faith in law, this love for truth, this sympathy with creature and Creator are the birth-right of every child; the school can give it; angels can do no more.

Mr. Charles N. Cobb, of the Regents' office, said that, however desirable it might be to have science taught in our schools by college graduates, the fact is that most of our science teachers are not college graduates. A large part of the science pupils of the State are in the small village schools. Many of the science teachers in these schools are normal graduates. The teacher of science in the normal school may be called on to teach physics, chemistry, zoology, physiology, geology, mineralogy and astronomy. The *established* normal course in this State gives 20 weeks to each of the first two previously mentioned sciences, and ten weeks to each of the others. This is modified slightly by the various normal schools.

The discussion of Mr. Cobb's remarks developed the fact that normal school graduates, prepared in this manner, frequently find their way into the high schools of the State as teachers of science, often, however, against the best judgment and advice of their normal school teachers.

Dr. C. W. Hargitt, of Syracuse Univer-

sity, referring to the lack of adequately trained teachers for the best sort of science work in the schools, said that a bungling or half-hearted teacher will never be able to produce satisfactorily prepared students, whatever time or equipment he may have at his disposal. The teacher who aims chiefly to prepare pupils for *examinations* will be equally unsuccessful. Examinations will take care of themselves if we have teachers whose primary aim is to teach science, to infuse into the mind of the pupil the scientific spirit.

It is gratifying to know that some of our normal school principals enter protest against the disposition to offer science positions to even normal graduates, if their special training for science teaching is inadequate. May it not come within the province of this Association to enter similar protest if necessary, aye more, to exercise a mild though vigilant censorship over the science work of the schools, and seek by every reasonable measure to secure constantly better results.

We must be cautious about placing biology among the exact sciences, or holding out unwarranted expectations as to the infallibility of experimental results. This may be all right in physics or inorganic chemistry; it is unsafe in biological teaching. The very fact that this is, preeminently the living science, having to do with the *occult* processes of *life*, the most distinctive character of which is change, renders many results in biological experimentation exceedingly capricious. Indeed this is one of the very charms of the science. Nor is its educational value any the less on this account.

Superintendent Henry P. Emerson, of Buffalo, spoke on some of the practical difficulties attending science work in the lower grades of city schools. Nature study lacks vitality unless it is begun early. A canvass of the school children in a number of Buffalo schools a few years ago revealed the fact that many of the pupils had never seen a lake, a hill, or the Niagara River. Hereafter every pupil in the fourth grade is to have at least *one* excursion a year, visiting some of the public works, the park and the river front. In the high school, excursion work has been a prominent feature in the study of botany and geology for the past twenty-five years, every Saturday during warm weather being improved systematically for the exploration of the vicinity. It is only by such studies, pursued in this manner, that the artificial and mechanical element of school work can be broken up.

Mr. Arthur G. Clement, of the Regents' office, said that in visiting over 175 schools of this State last year he saw some good science work even in our smaller villages where the teacher is usually one from the normal school.

The Regents have their ideals in regard to the teaching of science, but do not expect to see them realized until schools are more fully equipped. Accordingly the examinations in science are prepared in view of the conditions existing in the schools. It is the intention, however, that the nature of the questions shall indicate to some extent the kind and method of teaching which they hope to see gradually established in the schools, and it is expected that teachers will recognize these hints and act accordingly.

In zoology it is recommended to study a single type in each branch in accordance with laboratory methods. The order of progress should be from the lower to the higher, with constant attention to the increasing complexity of structure and its correlation with increasing differentiation of function from branch to branch. If properly done, this work will necessitate observation, discrimination and comparison, and it will impress the pupil with the idea

that the method of life is from the simple to the complex, which is the greatest lesson to be learned from this study, since it is also the method of growth of all social phenomena.

Professor A. D. Morrill, of Hamilton College, thought that if the colleges and universities knew more of the objects toward which the Regents are striving, and the difficulties with which they are contending, it would enable the colleges and universities to be of the greatest help in the advancement of science in the secondary schools.

The chief requisite for the instructor is to be able to arouse mental activity, to care more for the soul of the pupils than for the amount of knowledge that he can impart to them. Thorough scientific training can often awaken pupils who have been wholly uninfluenced by language teaching. It is not so important what the science is as how it is taught. When pupils are taught to use books and not to worship them they are in a position to begin to learn. But the laboratory is of no value except as a means to an end—the awakening of the pupil.

Professor R. E. Dodge, of New York, was glad to notice the emphatic disapproval of systematic botany and zoology. In the study of biology interest can be at once elicited by showing that all living things are attempting the same tasks of life in different and yet similar ways. Function as producing form, comparative morphology and forms as the result of function, should be studied in the early years of education. Thus a basis for interest and better love for nature can be aroused through the sympathy that comes from understanding.

Professor Warren Mann, of Potsdam Normal, was sure that if the same quantity and quality of work were given to science that are now given to languages the results would be equal to or even better than those in language courses. He would not cry down the languages, but he would cry up the sciences until they have an equal footing in all respects with the languages. The next ten years will witness great strides in science study. This Association should be one of the means to that end.

Professor B. G. Wilder, of Cornell, admitted that after thirty years of teaching he still found it dificult to determine the proper sequence of biological subjects and the manner in which they should be presented. He warmly commended the address of Professor Wm. North Rice, 'Science Teaching in the Schools.'* He heartily agreed with Professor Rice as to the introduction of elementary physiology into the lowest grade of schools, but urged that, instead of beginning in the fifth grade, the nervous system should have a place in the first. The very difficulty of the subject demanded that its rudiments be acquired early. Paradoxical as it sounds, the brain, as a gross object, is easier to study than the heart. He would have the sheep's brain put into the hands of the youngest scholars to draw and observe. At later stages comparison should be made with the brains of cats and dogs, and, still later, the general plan of the vertebrate brain should be elucidated upon that of the green turtle. In every high school should be at least one well-preserved human brain and a series illustrating the development of the organ. From scholars thus early and gradually familiarized with fundamental facts and ideas much might be expected in universities and medical schools.

Mrs. S. H. Gage, of Ithaca, spoke of the desirability of keeping the minds of the children pure by telling them the truth about their own origin and development.

Professor John F. Woodhull, of New York, in view of some of the criticisms of

* Delivered at the meeting of the American Society of Naturalists, December, 1887; printed in the *American Naturalist*, September and October, 1888. Published by D. C. Heath & Co.

science work in the State, contended that poor work in science is better than none at all. If we are ever to have good science teaching we must first *begin*.

There have been many sins committed under the head of 'teaching observation.' We are learning that one may be a very good observer in lines in which he is interested, but very unobservant in other lines. We must not expect more of the children than of ourselves. Observation is only good when you have some use for it, when you are looking for something to relate to something else. This is scientific observation.

Dr. Frank Baker, of the University of Georgetown and Superintendent of the National Zoological Park in Washington, remarked that the teaching of science in the schools of Washington, D. C., begins in the low grades, children being taught to observe common objects of biological interest, note their parts and describe them. They are often taken out upon excursions into the country to observe the geological formations, the plants and the animals. The Zoological Park, free to the public, is much used for this purpose. He also remarked upon the ethical bearings of science teaching.

Dr. Herbert Williams, of the University of Buffalo, was one of the few representatives of the medical schools of the State who were present. He thought that teachers in medical schools might have attended these meetings with much profit. Too little thought is given to *methods* of teaching, even in medical schools of the highest standing. He was delighted with the prominence given to laboratory work. Medical schools are constantly giving more time and increasing facilities to laboratory work. But, after all, this can include only a part of the field to be covered. The pupil can verify some of the facts given him to study, but the major part must still be learned outright and taken for granted. Yet laboratory work covering part of the ground studied gives a more concrete idea of the whole and makes the student feel more certain of the realness of what he learns second hand.

He was astonished that no one else seemed to have met with the difficulty that he had felt most keenly. Though he had the necessary laboratory equipment and an earnest, intelligent class of students, he found it very difficult to teach the large numbers that came to him—twenty-five to fifty at a time. Even with the help of two or three assistants he found it impossible to assure himself that every one of his pupils saw things correctly with the microscope and appreciated what he was looking at. Suppose a class is studying the amœba. The practical difficulties of showing the amœba to each of fifty students are great. If they are beginners you may use up an afternoon in finding amœbas for each of fifty students and in distinguishing them from air bubbles, bits of dirt, and all the innumerable living things seen in stagnant water, to say nothing of having your students interpret the object correctly after they have found it.

More time is needed for science work, and smaller classes, and he believed medical schools were trying to teach their students too much, but at present the situation must be met as practically as possible. The conditions in the high schools must often be very much the same in these respects as in the medical colleges, and it is surprising that high school teachers have not been more impressed with these difficulties.

Dr. Charles J. Walch, of Syracuse, spoke of the successful work in nature study in the Syracuse kindergartens, where the children study in their own gardens the development and growth of different plants. He warmly endorsed Mrs. Gage's sentiments.

Professor George F. Atkinson, of Cornell, thought that the outline for the study of zoology as presented in the Regents' Bulletin offered encouragement for the presentation of a much better course of study in this subject than was the case with botany.

With a few exceptions the study of botany in the high school is merely the study of the various members of the higher plants with the sole view of using this knowledge in 'running down' the plant to its name. This method of study has brought the science of botany into disrepute in many quarters. If we should study zoology in a similar way we might confine ourselves to the birds and study the various kinds of feathers, the modifications of the beak, toes, etc., with the sole purpose of using the knowledge of these things to trace, with the aid of a key, the bird to its name. No one would call such work zoology. No more is the similar method employed by many in dealing with plants botany, and yet in many places the word botany suggests that kind of study alone. It has sometimes seemed to the speaker that if it were possible to drop the word botany we might at the same time do away with certain prejudices against the study of plants; and if we should instead use the word *phytology* the study of plants would thus be placed among 'ologies,' and would at once, from the very name, be recognized as a science!

Regarding the study of types it was suggested that no plant is a type of a branch or class of plants, and that the study of several plants in a class would give a better knowledge of the characteristics of the class than the study of a single one. The study of a single plant or animal to represent a large group may be carried too far in the case of beginning students. By going deeply into the minute structure of a single plant or animal a mass of facts is obtained, which may be very interesting and wonderful, but which do not in themselves teach any great principle. It would be better for the young student to study the plant or animal less thoroughly and to study others of the same class in comparison.

Emphasis was laid on the importance of so conducting elementary science study as to bring frequent deductions of some fundamental law or principle from the few facts observed. Training in such methods of study, the comprehension of fundamental principles, and the tying together of the facts observed into a living whole, gives far greater power than the mere observation of many wonderful details of a few organisms.

Principal S. G. Harris, of Baldwinsville, seconded the ideas of the preceding speaker on the inductive method in biology. In the grades this method may be used to advantage in order to foster a love of nature and prepare the pupil for the work of the high school. By skillful questions and suggestions the teacher leads her pupils to see the facts of one form and another in nature about them. Frequent repetition of this operation fixes the habit; so that when the pupils reach the high school they have not only a habit of observation and a love for the study, but also the pegs on which they may hang subsequent knowledge—apperceptive centers about which new facts may be grouped. Then, and not till then, are they prepared intensively to study any living form, singly or comparatively.

No wonder some pupils do not take to the study of science in high school or college, if they must begin by mastering classification, technical terms and a sea of facts, without either a desire for the facts, a habit of seeing for themselves or a single fact by which to fasten their knowledge. Too often teachers seem to think than one must have the knowledge of a specialist to rightly teach pupils in these studies, so great is the field. Here is the danger, not that the teacher may know too much, but that she may *tell too much*. The idea is to

direct thought as induced by the object studied, not to pour into the young mind thoughts of others. There is no surer way of disgusting a child with nature than to give him laws and technical terms that are beyond his years.

Dr. Amelia Earle Trant, of the Buffalo high school, spoke from the standpoint of a high school teacher of physiology working under conditions not altogether favorable, such as large classes, and pupils with no previous knowledge of chemistry or physics. While thorough scientific work here is perhaps impossible, there are, however, certain definite results obtainable which are not only valuable and practicable, but also consoling and, on a broad outlook, satisfactory. She must be satisfied to ignore the meagre amount of technical physiology possible to be taught under such conditions, if a few things in English and ethics can be mastered.

For instance, she would be satisfied if the definition of physiology is so clearly understood that the word may be used interchangeably with its synonyms, use, function, action or office; if the distinction between the terms physiology, anatomy and hygiene is clear beyond question; if the vital, practical import of personal hygiene and of public sanitation is too firmly impressed to be forgotten; if the difference between vivisection and dissection is clear enough for missionary work in the household—information as to the value, the necessity and the place of each being so much needed in these days of sensational head lines; if the etiquette of class demonstration, is acquired, so that all material is regarded with appreciative interest rather than with amusement, flippancy or pseudo-disgust; if reverence for the wonder and the mystery of created things is so increased that the pupil's attitude of kindness could but be approved by the Humane Society; if a little lesson in broad-mindedness is learned and the Ainsworth Law found not to be the whole of alcohol; if interest has been aroused—even if the majority of boys, and girls as well, decide with the iridescent imagination of youth that they will be physicians; if the knowledge of physiological problems yet to solve will be likely to make simple reading of scientific discoveries interesting in the days to come; if at the end of the term most of the pupils are able to hold their own in a test from the outside, questions reasonable and broad, such as the Regents' examinations have been of late; and finally she is satisfied if, when leaving the subject, the pupils take with them its most important lesson of life—that the physiological axiom, "The well being of the whole depends upon the integrity of the unit," is also a great ethical truth, inexorable not only in the human organism, but also in the school, the family, the State and the Nation.

The other speakers were Professor H. J. Schmitz, of Geneseo Normal, and Dr. Frank McMurry, of Buffalo School of Pedagogy.

The convention closed with a business meeting Thursday afternoon. A number of changes were made in the constitution. It was decided to have a committee of nine members appointed by the President to report to the Association at its next annual meeting on the following subjects: (1) The recognition of science as a requirement for entrance to colleges. (2) Science courses for secondary schools. (3) Nature study in elementary schools.

The following officers were elected for the year 1897. The presidency was offered to Professor Gage for another year, but at his earnest request, another was nominated in his stead.

President, Dr. E. L. Nichols, Cornell University; Vice-President, Dr. Charles W. Hargitt, Syracuse University; Secretary and Treasurer, Dr. Franklin W. Barrows, Buffalo High School.

Executive Council. Four years—Dr. Charles W. Dodge, University of Rochester; Principal Henry Pease, Medina High School; Professor W. C. Peckham, Adelphi College, Brooklyn. Three years—Dr. J. McKeen Cattell, Columbia University, New York; Professor LeRoy C. Cooley, Vassar College, Poughkeepsie; Professor E. R. Whitney, Binghamton High School. Two years—Professor Irving P. Bishop, Buffalo Normal School; Mr. Charles N. Cobb, Regents' Office, Albany; Professor C. S. Prosser, Union University, Schenectady. One year—Professor Albert L. Arey, Rochester Free Academy; Professor R. E. Dodge, Teachers' College, New York; Professor T. B. Stowell, Potsdam Normal School.

FRANKLIN W. BARROWS,
Secretary.

MIGRATION OF BATS ON CAPE COD, MASSACHUSETTS.

BAT migration has received little attention. Various writers have made vague reference to the fact that certain bats are found in winter at localities where they are not known to breed, but no detailed account of the migratory movements of any species has yet been published. The only special paper on the subject that I have seen is by Dr. C. Hart Merriam,* who clearly establishes the fact that two North American bats migrate. The data on which this conclusion rests are as follows: The hoary bat, one of the migratory species, is not known to breed south of the Canadian fauna. In the Adirondack region it appears about the middle of May and disappears early in October. During the autumn and winter it has been taken in South Carolina (Georgetown, January 19th), Georgia (Savannah, February 6th), and on the Bermudas† ('autumn'). As the writer remarks, these facts may be fairly regarded as conclusive evidence of migration. The evidence of the migratory habits of the silver-haired bat rests chiefly on the animal's periodical appearance in spring and fall at the lighthouse on Mount Desert Rock, thirty miles off the coast of Maine. This species has also been observed on the Bermudas.

In August and September, 1890 and 1891, I had the opportunity to watch the appearance and disappearance of three species of bats at a locality where none could be found during the breeding season. Highland Light, the place where my observations were made, is situated near the edge of one of the highest points in the series of steep bluffs of glacial deposit which form the outer side of Cape Cod, Massachusetts. The light, which is less than ten miles from the northern extremity of the cape, is separated from the mainland toward the east and northeast by from twenty-five to fifty miles of water. The bluff on which it stands rises abruptly from the beach to a height of one hundred and fifty feet. I found the bats for the most part flying along the face of this bluff, where they fed on the myriads of insects blown there by the prevailing southwest winds. They chiefly frequented the middle and upper heights and seldom flew over the beach at the foot of the bluff or over the level ground about the lighthouse. I do not know where the animals spent the day, as careful search in old buildings, under the overhanging edge of the bluff, and in deserted bank swallow holes, failed to reveal their hiding places. It is possible that they found shelter in the dense, stunted, oak scrub with which the bluff is in many places crowned, but of this I have no evidence. I hope that the observations given below may again call the attention of field naturalists to a subject which presents many difficult and interesting problems.

ATALAPHA NOVEBORACENSIS* (RED BAT).

August 21, 1890. The first bats of the season were seen this evening. There were

*Trans. Royal Soc. Canada V (1887), Section V, p. 85, 1888.

† I may add that I have a bat of this species, killed at Brownsville, Texas, on October 22d.

*With bat nomenclature in its present unsettled state it is well to use the names adopted by Dr.